NUI Galway
OÉ Gaillimh

Autumn Examinations 2010

Exam Code(s)	3IF
Exam(s)	3rd Year B.Sc. Examination
Module Code(s)	CT332
Module(s)	Database Systems II
Paper No.	
Repeat Paper	
External Examiner(s)	Professor M. O'Boyle
Internal Examiner(s)	Professor G. Lyons Dr. J. Duggan *Mr. C. O'Riordan

Instructions: Answer any **FOUR** questions.
All questions carry equal marks.

Duration	3 hours
No. of Pages	4
Department(s)	Information Technology
Course Co-ordinator(s)	

Q.1. i) Describe a procedure you might adopt to develop a relational schema from an ER diagram.

Explain how the process would differ if you were developing a schema suitable for an Object-Oriented Database.

Your answer should include a description of how you would deal with entities (strong and weak), attributes (atomic, composite, multi-valued), relationships (binary, n-ary, 1:1, 1:M, N:M).
Include examples to illustrate your explanation. (16)

ii) Discuss the properties of a well designed relational schema. (7)

iii) Explain the process of database design by synthesis. Your answer should include an explanation of functional dependencies, closure and cover sets.
Illustrate your answer with an example. Outline any disadvantages associated with this approach. (10)

Q.2. i) Given the following company database schema:

EMPLOYEE:	RSI, Fname, Lname, Salary, Address, Age, Dno
DEPARTMENT:	Dno, Dname, Description
DEPT_LOCN:	Dno, DLocation
PROJECT:	Pno, Pname, Budget, Proj_Desc, Plocation
WORKS_ON:	RSI, Pno, Hours

provide an SQL query for the following:

List all employees (Fname, Lname) who work for a department based in "Dublin" *or* who have worked more than 10 hours on a project located in "Dublin".

Outline the process of heuristic optimisation. Develop an operator tree that represents an efficient evaluation strategy for the above query. (15)

ii) Discuss the structure of a B tree and describe, with an example, the algorithm for insertion of values into a B tree. (9)

iii) Compare, in terms of data retrieval in databases, the efficiency the B Tree and B+Tree data structures. (9)

Q.3. i) Explain briefly the importance of concurrency control in multi-user databases. Outline the problems that may arise if concurrency control is not enforced. (6)

ii) Timestamping and two-phase locking are two approaches to ensuring concurrency control. Outline *either* approach and present pseudo-code for the primitives used. Show how the following schedule would proceed under *either* protocol.

Ta	**Tb**	**Tc**
		read_item(X)
		read_item(Y)
	read_item(Y)	
	read_item(Z)	
read_item(X)		
read_item(X)		
	read_item(X)	
	read_item(W)	
	write_item(W)	
		write_item(X)
write_item(Y)		

(17)

iii) Explain, with respect to recovery, the importance of a *commit point* of a transaction. Given the following fragment of a log, describe how recovery might proceed under an immediate update protocol.

[start_transaction, T1]
[read, A, T1]
[write, A, 10, 12, T1]
[start_transaction, T2]
[read, A, T2]
[write, A, 12, 13, T2]
[commit, T1]
[read, B, T2]
[write, B, 50, 60, T2]
[checkpoint]
[start_transaction, T3]
[read, C, T3]
[write, C, 45, 60, T3]
[read, D, T3]
[read, C, T2]
[read, D, T2]
[write, C, 60, 61, T2]
[write, D, 100, 0, T2]
[commit, T2]
<crash>

(10)

Q.4 i) With respect to deductive databases, explain, with examples, the terms: *fact, rule, rule safety,* and *backward-chaining.* (8)

ii) Choosing appropriate facts, illustrate how the standard relational operators can be provided in Datalog. (8)

iii) Compare Object-Oriented, Object-Relational, and relational models – describe the differences in models and query languages supported. Your answer should also include the language constructs supported in the query languages associated with DBMSs adopting the models. (8)

iv) With respect to parallel databases, explain with examples, the following types of parallelism that can be achieved. (9)